A MERCURY INTERRUPTER FOR LARGE COILS

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THE following is a description of a mercury interrupter, built on the turbine principle, which is suitable for use with induction coils of one kilowatt capacity, or less. The interrupter will operate satisfactorily at a speed of 600 revolutions per minute, at which speed it makes and breaks the circuit 600 times per minute. For higher frequencies it is only necessary to drive the interrupter at a higher speed. The limit to frequency is determined by the time constant of the induction coil with which it is used, and the simplest method of obtaining the proper speed is by trial with the given coil. The advantages of this interrupter over one of the mechanical break type are: Quickness of break, which increases the size of spark for the given coil; absolute quietness, which is of especial importance in x-ray work; reliability, due to the fact that there are no contact points to burn unevenly or to stick, as is the case with mechanical breaks. The materials used in construction are cheap and easy to acquire.

The following description refers to Fig. 1, which is a vertical section of Fig. 2, taken through the center.

The base *A* is of soft wood, 1½ in. thick, turned to a 9-in. diameter at the bottom and 6½-in. diameter at the top. A circular hole, just large enough to take a 5-in. pipe (about 5¼ in.), is then countersunk to a depth of ¼ in. in the top face. This hole should be centered.

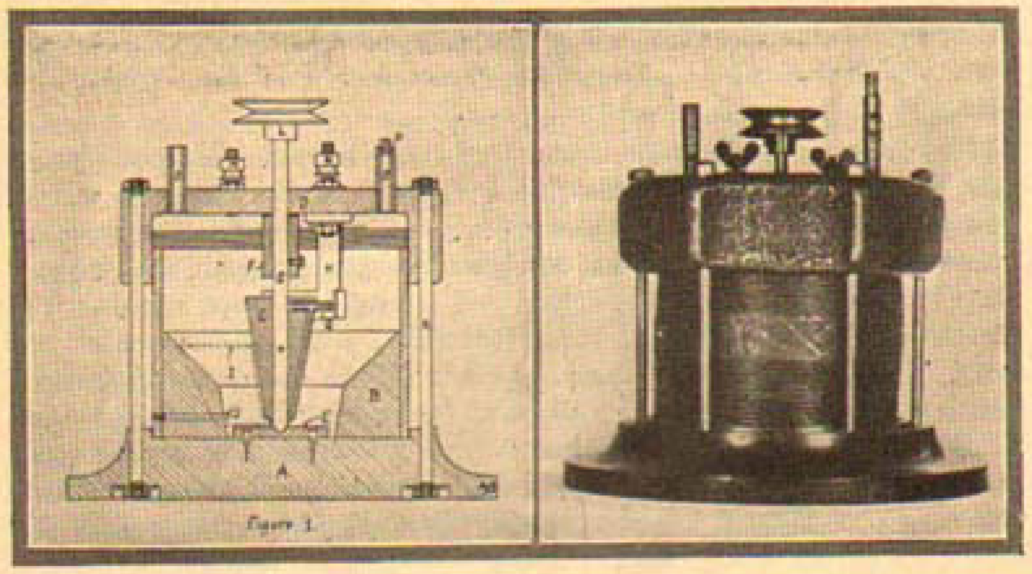
Obtain a piece of 5-in. pipe 4 in. long, threaded on one end (a 4-in. nipple will do) and a 5-in. pipe cap. Screw this nipple as far as possible into the cap *D*, mount in a lathe, and face off outside end of nipple parallel to outside face of cap. The total height from outside end of nipple to outside face of cap should now be 5¼ in. Find and mark center of outside face of cap, and draw with this center three circles of 3-in., 2-in. and 1½-in. radius, respectively. Divide the 3-in. radius circle into six equal parts spacing the dividing points opposite the outside lugs on the cap, which are made for a wrench grip. (See Fig. 2.) At these points drill ¼-in. holes to take the bolts *K*. Take two diametrically opposite points on 2-in. radius circle and drill and tap holes at these points to take two short pieces of ⅛-in. gas pipe *O*. One of these gas pipes is plugged at its outer end with a metal plug *P*, which has a small hole (about $\frac{1}{16}$ in.) drilled through it, longitudinally. *P* had best be threaded

into *O*. On the 1½-in. circle choose two points 2¼ in. apart so that a line through these points will be parallel to a line through the centers of the two holes made for *O*. Drill and tap a hole at one of these points for a ¼-in. threaded binding post *M*. The binding posts *M* and *N* (to be mentioned later) are made from ¼-in. iron or steel stock, and supplied with necessary ¼-in. washers and nuts. Either a wing nut or a knurled head nut can be used for the movable part. At the other point a ½-in. hole should be drilled. Now place cap and nipple in countersunk recess in base *A* and mark and drill ¼-in. holes in base for bolts *K*. The lower ends of these holes should be countersunk 1-in. diameter for about ¼-in. depth, to take nut and washer of bolts *K*, as shown in Fig. 1. The bolts *K* are made from ¼-in. iron stock and threaded on each end. Drill and ream to ⅝ in. a hole at the center point of cap *D* to admit shaft *G* of revolving part.

The shaft *G* is of ⅝-in. cold-rolled steel 7 in. long, and is turned to a point at lower end, on a 60-degree bevel. Obtain a piece of close-grained hard wood 2 in. square, and 2¾ in. long, with the grain running lengthwise. Center one end and drill a ⅝-in. longitudinal hole through it. Slide this block of wood on shaft, and pin it to same by means of a small wire nail *O*, being sure to have lower end near point of shaft. Place shaft in a lathe and turn down this block of wood to shape *C*. The top diameter is 1½ in. and the bottom diameter, before beveling, is ⅝ in. The lower end is then beveled at a 45-degree angle. Drill and top radial hole 2¾ in., from point of shaft, for *Q*. This is a piece of 3/16-in. steel stock ⅞ in. long, threaded, and having a longitudinal 1/16-in. hole drilled through it with a 1/16-in. hole drilled in its side, 3/16 in. from the end, to meet said longitudinal hole. A ¼-in. hole is now drilled in *C*, starting at the bottom adjacent to shaft, and intersecting hole already drilled and tapped for *Q*. This hole must be parallel to face of *C*, or in other words, must be in the same plane as the axis of the shaft *G*. This is the correct design, since centrifugal force alone is relied on to shoot stream of mercury out of *Q*. The latter is now screwed into *C* until the hole in its side comes opposite the ¼-in. hole in *C*, and in this position the outer end of *Q* should be about 1⅛ in. from the center of shaft *G*. A collar *F*, with set screw, is next made for shaft *G*, out of ¾-in. steel stock 1¼ in. long. This large size is used in order to counteract the buoyant force of the mercury in the well, on *C*, and thus reduce friction between *F* and *D*.

A piece of ¼-in. iron or steel plate *E*, 2 in. by ¾ in., has a 60-degree conical hole drilled in its center, to be used to seat the lower end of shaft *G*. *E* also has two holes drilled into it for screws to fasten it to base *A*. The piece *E* is centered for fastening to base *A* by passing shaft *G* through its bearing in *D*, and placing same on base *A*. If *E* has already been placed near the center of *A* it can now easily be centered, by moving *G* up and down until it seats squarely. *E* is now screwed to base *A*, after first removing *G* and *D*. The collar *F* should now be adjusted, by trial, for free running of shaft *G*.

The contact piece *H* is cut from 1/16-in. sheet iron in the form of



The mercury interrupter in section and photo of the completed device.

a letter "T." The cross part should be 3½ in. long and ¾ in. wide, and the stem part 2⅛ in. long and 1 in. wide. This makes the total height of the "T" 2⅞ in. and the total width 3½ in. Hold this "T" vertically, with the cross down, and bend the cross until its lower edge lies along a horizontal circle of 1⅜-in. radius. It is with this cross part of *H* that the stream of mercury from *Q* makes contact, and it is bent in an arc in order to be at a constant distance from the end of *Q*, as the shaft *G* revolves. The stem part of the "T" is now bent at a right angle along a line 2 in. from the farther edge of the cross part, and in the same direction as the ends of the cross part, curve. The bent end of the stem is now drilled and tapped ¼ in. at such a point that, when *H* is mounted

on binding post N, the inside face of the cross part of H will be just ¼ in. from the outer end of Q. The binding post N is electrically insulated from cap D by means of a fibre bushing, having a shoulder 1 in. outside diameter and ¼ in. thick, on one end. The body of this bushing is of ½ in. outside diameter to fit hole in D and of sufficient length to pass clear through the cap D. This bushing should be drilled and tapped ¼ in. to fit binding post N. H and N are now assembled as shown in Fig. 1, and fastened to cap D, with the shoulder of the fibre bushing on the bottom next to H, and a flat fibre washer on the top of D, under the fastening nut Q, in revolving should now come opposite or slightly above the center of the cross part of H. Care must be taken in making the fibre bushing, as the mercury has a tendency, in splashing, to short circuit N and the cap D. The above dimensions give ample insurance against this.

In order to reduce the amount of mercury for the operation of the interrupter, a block of wood B is used to diminish the size of the mercury well. B is a block of wood, hard or soft, 2¼ in. thick, turned in a lathe to such an outside diameter (about 5 in.) that it can just be driven into the lower end of the 5-in. pipe nipple. The inside diameter is 2¼ in. at the bottom, 2⅝ in. at the center and 4⅛ in. at the top. After driving block B into the pipe nipple until flush with bottom of same, a piece of ⅛-in. iron stock J is threaded, and screwed through the block B into a threaded hole previously made for it in the nipple. J is used to insure good contact between binding post M and the mercury in the well. In order to keep the mercury in the well from revolving with C a baffle plate I, made of sheet iron, is wedged into a saw cut in block B. This plate I does not come in the section shown in Fig. 1 and for that reason is represented dotted. The baffle may be inserted at any point on inside circumference of block B.

The interrupter is now complete and should be assembled and the bolts K drawn tight. The mercury may now be poured in through pipe O. For the dimensions given 4½ lbs. of mercury should be used. All metal parts of the interrupter which come into contact with the mercury must be made of iron or steel, as the mercury will alloy with and dissolve any other metal.

In the illustrations shown, a pulley L is mounted on the shaft G to permit belt drive. A direct drive by electric motor or otherwise is more satisfactory, and for this use the pulley L is necessary. A good flexible coupling for the interrupter can be made of a short length of thick-walled rubber tubing. With a coupling of this type, the motor need not be run with its shaft vertical, since the tubing will allow a right angle bend. In operating, illuminating or other gas is allowed to pass through the interrupter, entering at O and being ignited at P. This supply of gas is essential, as it prevents the burning or oxidizing of the mercury and contact piece H. If trouble is had in maintaining an even flame at P, the pipe O into which P is screwed may be stuffed with cotton, which should steady the flame.

SOME WORKSHOP TIPS FOR HOME MECHANICS

TIDINESS in the workshop goes a long way toward producing good work; and what is more, if things are always kept in one definite place so that everything, both tools and materials, can be found *easily*, just when they are wanted, many a little job is done at once, which would otherwise be put off until "to-morrow" and, as the domestic authorities will tell you, "to-morrow" will never arrive, says a writer in *Junior Mechanics*.

To Secure Recognition

Now, many a budding mechanic has had his career cut short through nobody's fault but his own. If he is unfortunate enough to be the only member of the household with a natural leaning toward things mechanical—or electrical, for that matter—he should be prepared to render his services to the above-mentioned authorities the moment the first opportunity arrives.

A Gas Leak

It may be a smell of gas is reported. If after a good look around with a few matches or a taper, the leaky joint is revealed, don't put the job off because there is no red or white lead in the house, but apply a little soap as you would putty when on a woodwork job. This will prove quite effective for a length of time, and is better than paint. The latter is really not much use unless it is applied to the screw thread of the piping or fitting before it is screwed up. It is too thin to use as "putty" for, by the time it has dried, the gas will certainly have forced its way out again, and we are but little better off than we were at the start.

It should be understood, however, that the foregoing hints only refer to very minor leakages such as may occur on gas brackets, burners, or fittings. If there is the slightest possibility of the es-